Testing for Japanese Beef Trade Impact from BSE Using a Time−Varying Armington Model

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Testing for Japanese Beef Trade Impact from BSE Using a Time-Varying Armington Model

Byung Min Soon and Wyatt Thompson

Motivation

In 2004, Japan banned U.S. beef imports because of an outbreak of Bovine Spongiform Encephalopathy (BSE) in the U.S. This beef import ban affected bilateral trade flows and, because Japan accounts for a large proportion of world beef trade, had global market impacts.

Research Question

What was the effect of the U.S. BSE outbreak on Japanese bilateral beef trade?

Objective

This article examines the impact of the BSE outbreak on the Japanese beef market by using a time-varying Armington model.

Procedures

We conduct two procedures.

1. Time-varying parameter values estimated over data from the pre-BSE and post-BSE periods are used to explore the impact of the BSE outbreak on levels of the product substitutes and consumer preferences over time.

2. Time-varying parameter values extrapolated from past trends in the pre-BSE period are used to estimate beef demands. The difference between actual and estimated beef demand measures the impact of the U.S. BSE outbreak on the Japanese beef market.

Methods

The Armington model is derived from a constant elasticity of substitution utility function:

\[ U(D, I) = \left( \frac{D}{D^a} + (1 - \delta) \frac{I}{I^a} \right)^{\frac{1}{\sigma}} \]

where \( D \) = domestic beef consumption, \( I \) = total imported beef consumption, \( \sigma \) = elasticity of substitution, \( \delta \) = country of origin bias, \( \theta \) = elasticity of substitution between either imported beef and \( \phi \) = relative preference between imported beef.

A standard econometric equation with a time-varying parameter:

\[ y_t = \beta_0 + \beta_1 p_t + \epsilon_t \]

\[ \beta_t = \lambda_0 + \lambda_1 \sin(\frac{2\pi t}{T}) + \lambda_2 \cos(\frac{2\pi t}{T}) + \lambda_3 \sin(\frac{4\pi t}{T}) + \lambda_4 \cos(\frac{4\pi t}{T}) \]

\[ y_t \] = consumption ratios by logarithm. \( p_t \) = price ratios by logarithm. \( \beta_t \) = the time-varying elasticity of substitution. \( \beta_t / \beta_0 \) = the time-varying country of origin bias. \( t \) = time and \( T \) = the number of observations.

A Structure of the Armington Model

We provide a structure of the Armington model with various beef types:

- Japanese beef demand
- Wagyu Other = Imported beef
- Other domestic beef
- Imported beef (Alternative 1)
- Imported beef (Alternative 2)
- U.S. AUS Frozen
- AUS Frozen
- U.S. Chilled AUS Chilled

Comparisons between Actual and Estimated Japanese Beef Demands

<table>
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<tr>
<th></th>
<th>2000</th>
<th>2005</th>
<th>2015</th>
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<tbody>
<tr>
<td>Chilled Frozen</td>
<td>41</td>
<td>56</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>48</td>
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Source: Agriculture and Livestock Industries Corporation (ALIC).

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Conclusions

The U.S. BSE outbreak has mainly changed the elasticity of substitution and the country of origin bias for imported beef from the U.S. and Australia, while Japanese domestic beef demand has been less affected by the BSE outbreak. Based on time-varying parameter estimates, the BSE outbreak caused higher demand for Australian beef and lower demand for U.S. beef, while domestic beef demands were only modestly affected. Specifically, the outbreak affected imported frozen beef demands more than imported chilled beef demands.

Our results show gains to Australian beef suppliers as Japanese importers switch sources and modest gains to domestic beef producers as the U.S. loses.. In addition, the results show that time-varying parameter model improves the estimation, compared to the fixed parameter model.

References


Acknowledgements

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